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ABSTRACT

Guidelines for the development of courses and programs of industrial arts for local school districts in New York State are provided in this guide designed for administrators, curriculum personnel, supervisors, and teachers. Following a discussion of student program options, a basic series of suggested courses (titles and course topics) are provided as a starting point for the development of local industrial arts programs. The courses include the following: ceramics (products and structural ceramics); drawing (developmental and production drawing); electricity; graphic arts (photographics and offset); metals (bench and production metals); (plastic products and processes); power mechanics (small engines and vehicle power); and woods (products and structure). The next series of courses provided are suggested survey courses designed primarily for conceptual development. These include graphics technology (publications and engineering drawing), production technology (construction and manufacturing), and power technology (transportation and aerospace). Following this, program development steps and course development procedures are briefly discussed. The next section provides a list and brief description of the information that should accompany an application for course approval for New York State Diploma Credit; this includes program description, individual course information (title, length, grade level, prerequisites, content outline, and references and resources). An example of individual course information is provided. The last section (the major part of the document) includes an approved teaching guide for a course in wood products. Listed in column format are student objectives, instructional strategies, student learning experiences, and evaluative suggestions. The topics covered in the teaching guide are design, tools and machines, assembly, fasteners, finishes, forestry, and industrial organization. (JH)

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INDUSTRIAL ARTS EDUCATION

GUIDE FOR CURRICULUM

AND PROGRAM PLANNING

SECONDARY LEVEL

THE UNIVERSITY OF THE STATE OF NEW YORK
THE STATE EDUCATION DEPARTMENT
BUREAU OF OCCUPATIONAL EDUCATION CURRICULUM DEVELOPMENT
ALBANY, NEW YORK 12234

1979

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FOREWORD

This publication, *Industrial Arts Education Guide for Curriculum and Program Planning*, is designed to assist administrators, curriculum personnel, supervisors, and teachers in the development of courses and programs of industrial arts for local school districts. The content deals with student options, course-to-program relationships, program development, course development, and procedures to follow when requesting Regents' credit approval for a total program and/or individual courses.

Included also is an approved teaching guide for a course in Wood Products. John Loss, teacher of industrial arts at the Lewiston-Porter Junior High School, Youngstown, New York, prepared the original materials for this course. Additional developmental work was provided by John Bergmann, teacher of industrial arts at Troy High School, Troy, New York.

Assistance relating to program direction was provided by staff members of the Bureau of Industrial Arts Education. The project was coordinated and the manuscript prepared for publication by Nelson S. Maurer, associate in the Bureau of Occupational Education Curriculum Development.

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CURRICULUM AND PROGRAM PLANNING

Good instruction requires a plan of action that outlines content, teaching methods, and student activities including learner outcomes and standards of performance. This can be done **effectively** by local school personnel because they are able to identify needs and develop custom-designed courses and programs to meet these specific needs. The implementation of this concept requires the coordinated efforts of staff members to develop courses that are relevant to the learner's needs and yet consistent with the district's total educational plan. This publication is designed to assist school personnel develop courses and programs of industrial arts to meet local needs.

Student Options

Secondary school students have several options available when they choose their school program. Within each of these options there are numerous avenues for educational focus and career concentration. State and local required courses occupy only a part of the student's schedule. Therefore, within each of the options, students have considerable opportunity to choose elective subjects.

All students are not motivated by the same type of educational experience. Because of their unique content, instructional methods, and physical facilities, industrial arts courses have special appeal to many students. Industrial arts courses provide an opportunity for some students to display their abilities, gain status, and improve self-image. Other students with a heavy academic schedule welcome the opportunity for a "change of pace" in their school program that is inherent in courses emphasizing practical activities. Thus, industrial arts courses may well be an interesting and valuable part of any student's school experience.

A total program for industrial arts should be designed to serve at least three groups of students: first, those students whose main educational program is at the home school and who need assistance in making career decisions; second, those who, during the 11th and 12th year, pursue training at an area occupational center; and third, those bound for some sort of a post-secondary educational program.

The first group of students should have a broad spectrum of learnings in a number of different activities. The goal of technological adaptability has special relevance for these students because they undoubtedly are going to leave high school needing either to adapt to a variety of work situations or learning choices. Industrial arts provides these students an opportunity to evolve a real sense of self as they try out various hands-on activities to discover personal talents and/or attributes and investigate activities related to career choices.

The second group of students should be offered opportunities for exploratory or orientation experiences related to their occupational choice. These experiences should emphasize the discipline of the work place and involve attitudes and an understanding of the fundamental processes which would further the development of the individual's concept of earning a living, sharing with others, and accepting responsibility. The development of these concepts is especially important for students with a specific occupational goal.

The third group of students should have opportunities that are challenging and identifiable by the learner as relevant to his or her interests. Industrial arts courses that emphasize research and development activities would provide suitable experiences for this group.

These three groups cannot be served by the same courses, the same methodology, or the same time commitments. Therefore, specific courses need to be designed to accommodate the needs, abilities, and goals of each group.

Course Selection

The vista of the future will involve a number of broadly based technologies. If students are to develop an adaptability to these technologies, there must be the potential for them to acquire knowledge, basic skills, and attitudes and understandings in a variety of related experiences. The learning environment and the instructional capabilities to achieve this necessary breadth requires a program involving at least eight industrial areas. The following suggested courses are listed as a starting point for the development of local programs for industrial arts.

BASIC SERIES

The *Basic Series* of one-half unit electives establishes a general sequence for most students. These courses allow considerable latitude and adjustment to meet varying abilities. A student's program of electives may be selected from this group.

The content, or topics to be studied in each of these one-half unit courses is identified below. The number following each course title is the reporting code used by the Basic Education Data System (BEDS).

CERAMICS

Ceramic Products - 5140

Familiarizes the student with those ceramic products that are manufactured or developed in a plant for use at another location.

Enamels - Metal coatings, bonding
Glass - Processing, cutting, bending, products
Plaster - Molds, forms

Ceramic Products (Continued)

- Whitewares - Processes, types, products
- Glazes - Chemistry, application, uses
- Electrical - Insulators, porcelain, graphite
- Material Science - Earth, stone minerals, cermets, effect of heat
- Industry and Careers - Organization, location, jobs, working conditions

Structural Ceramics - 5142

Involves those activities, materials, and products that are used in construction and on-site applications.

- Cements - Portland, natural, processing
- Concrete - Forms, mixes, products, testing, aggregates
- Structural Units - Block, tile, brick
- Structures - Precast, integral, reinforcement, stone
- Refractories - Firebrick, kilns, heat, materials
- Gypsum and Lime - Material, products, plasterboard
- Abrasives - Materials, grit, coated, bonded, wheels
- Industrial Organization - History, development, labor, management

DRAWING

Developmental Drawing - 5144

Surveys projection theory, spatial relationships, and size and shape descriptors, plus sketching and drawing instrument use.

- Preparation - Language, purpose, tools, resources
- Sketching - Oblique, isometric, perspective
- Working Drawings - Orthographic projection, dimensioning
- Charts, Graphs, Maps - Flow, bar, line, area development
- Flat Developments - Packaging, sheet metal, geometric constructions
- Construction - Dwellings, public buildings, highways, airports, environment
- Careers - Drafting, architecture, maintenance, servicing, educational requirements

Production Drawing - 5146

Encompasses industrial applications, idea development, and sketching related to product design.

- Sketching - Product design, improvement, alternates
- Jigs and Fixtures - Stops, templates, gages, patterns
- Fasteners - Screws, bolts, rivets, welds
- Machine Parts - Tools, clamps castings, sections, auxiliary views
- Assemblies - Machine, exploded, dies
- Power Transmission - Cams, gears, chain, belt, shafts
- Manufacturing - Product design, part details, plant/production layout
- Production Personnel - Responsibilities, lead time, quality, upgrading, engineers, technicians

ELECTRICITY

Electricity - 5148

Covers the fundamentals of the theory, application, generation, transmission, and use of electric power.

Theory - Electrons, insulators, conductors, resistors, magnetism, Ohm's law

Measurement - Ammeters, voltmeters, ohmmeters, multimeters

Circuitry - Series-parallel, coils, transformers, loads

Motors - Direct, alternating, synchronous, universal, series

Light-Heat - House wiring, fixtures, illumination, heaters

Batteries and Generators - Primary cells, secondary cells, generators, alternators

Power Generation and Transmission - Water, fuel, atomic, power lines, transformers

Industrial Organization - Organization, services, jobs, electrical codes

Electronics - 5150

Involves the study and activities of electronic principles and systems related to communication and control.

Electron Theory - Emission, control

Meters and Instruments - Volt, amp, ohm, multi, oscilloscope

Inductance and Capacitance - Electromagnetism, fields, coils, chokes, transformers, capacitors

Tubes and Semiconductors - Rectifiers, amplifiers, oscillators, detectors

Amplifiers-Oscillators - Tuned circuits, converters, resonance

Radio and Television - Frequencies, heterodyning, transmitters, receivers, transceiver, signals, modulations

Computers: Controls and Switching - Switching, pulses, gates, relays, photoelectric controls

Careers and Industry - Guidance, industries, service shops, engineering, research

Graphic Arts

Photographics - 5152

Encompasses the photographic processes related to the printing industry and its career potentials.

Cameras - Shutters, lenses, body, types, stops

Exposures - Time, light

Films - Emulsions, bases, ratings, ortho, pan, color

Chemistry - Silver, developers, stop bath, fixer

Development - Procedures, tools, lights, trays, tanks, agitation

Prints - Equipment, procedures, special effects, enlargements

Evaluation - Contrast, detail, highlights, grain, purposes

Reproduction - Media, processes, illustration, advertising, halftones

Careers and Industry - Producers, finishers, services, industrial, X-ray

Offset - 5154

Emphasizes the theory, processes, and techniques of offset reproduction, and career information.

- Lithography - Processes, methods, theory
- Copy Preparation - Line copy, half-tone copy, screening, pasteups
- Photography - Cameras, films, photo mechanics, chemicals
- Platemaking - Stripping, processing, direct image
- Duplicating - Spirit, stencil, electrostatic, sensitized paper
- Presses - Operation, inks, paper, blankets
- Bindery - Signatures, covers, binding, trimming, stitching
- Careers and Industry - Job classifications, management, labor

METALS

Bench Metals - 5156

Covers the fundamental processes of metalwork coupled with the study of sources of raw materials and related metalworking careers.

- Sheet and Band - Products, measurement, forming/shaping processes, fastening, finishing
- Welding - Arc and acetylene, cutting, weldments, spot welding, brazing
- Measurement - Rules, micrometers, calipers, gages, metric
- Bench Processes - Drilling, reaming, sawing, abrading, lubricants, fasteners, finishing
- Raw Materials - Sources, processing, purchasing
- Industry and Careers - Heating/ventilation, equipment, repairs, sales

Production Metals - 5158

Encompasses the fundamental concepts and techniques of metal shaping, treatment, and production.

- Industrial Requirements - Design, materials, and characteristics
- Machines and Equipment - Drilling, turning, milling, grinding
- Forming - Forging, stamping, spinning
- Casting - Methods, patterns, sand molding, lost form, finishing
- Metallurgy - Materials, alloys, treating
- Industrial Organization - Steel producers, fabricators, dealers, labor, management, economics, research, automation, community resources

PLASTICS

Plastics Products - 5160

Includes the design and production of manufactured products using the basic materials of the plastics industry.

- Molding - Injection, compression, materials, molds, cycling
- Thermoforming - Molds, vacuum, blow, materials, finishing

Plastics Products (Continued)

Fiber Reinforced Plastics (FRP) - Polyester resin, glass cloth, mat, catalyst, forms

Extrusion - Profile shapes, molds, dies

Foams - Beads, expansion, forms, styrene, urethane, catalysts

Rotational Molding - Organosols, plastisols, cycling

Encapsulation - Resins, molds, catalysts

Industry and Careers - Diversity, applications, distribution, sales, jobs

Plastics Processes - 5162

Involves the study of the basic chemistry and processes related to the manufacture of plastic products.

Polymer Chemistry - Identification, classification, resins, materials testing

Mold - Gypsum, epoxy, metal, elastomeric

Laminates - Low pressure, high pressure, reinforced

Flexible Foams - Urethane, catalysts, structure, ethylene

Coatings - Cold dip, fluidized bed, paint, fabric, hot dip

Bonding - Welding, cementing, chemical solvents

Packaging - Films, sealing, shrink pack

Industrial Organization - Locations, plants, employment, technicians

POWER MECHANICS

Small Engines - 5164

Introduces the principles, design, construction, operation, and service of small engines.

Construction - Two-stroke cycle, four-stroke cycle, rotary, outboards, block, crankshaft, valves

Fuel Systems - Carburetors, pumps, controls, fuel, governors

Lubrication - Friction, bearings, splash, pumps, rings, oils

Cooling Systems - Air, water

Ignition Systems - Magnetism, magneto, points, condenser, coil, plugs

Care and Maintenance - Oil, oil cleaners, cooling, fuel

Power Transmission - Clutches, chain, sprocket, bearings

Industry and Careers - Manufacturers, service policies, repair shops

Vehicle Power - 5166

Covers the principles of consumer maintenance, operation, design, and function of power and transportation devices.

Gasoline Engines - 4-6-8 cylinders, fuels, ignition, cooling, lubrication, electrical

Diesel Engines - Compression, injection, fuel, blowers

Rotary Engines - Turbines, rotating combustion

Maintenance - Body, accessories, trim, battery, radiator

Vehicle Power - 5166 (Continued)

Power Transmission - Gears, clutches, differentials, universals,
hydraulics, pneumatics

Industrial Organization - Guidance, organization, dealers, parts
distribution

WOODS

Wood Products - 5168

Encompasses the study of the technical problems inherent in the
manufacturing of wood products including product development and
design and the tools and plans needed to manufacture usable articles.

Design and Planning - Elements, selection, procedures, layout

Tools and Machines - Safety; drilling, cutting, shaping, sanding
equipment; maintenance

Assembly - Adhesives, clamping devices, joints, jigs and fixtures

Fasteners - Nails, screws, bolts, special types

Finishes - Purposes, preparation, classifications, solvents, application,
maintenance, safety

Forestry - Products, conservation, recreation, legislation, research
and testing, classifications

Industrial Organization - Management, specialists, labor elements
of production

Structures - 5170

Introduces the principles, techniques, and applications of home construction.

Design and Planning - Building sites, plans, styles, financing,
regulations, bonding, contractors

Tools and Portable Machines - Safety; measuring, cutting, boring,
fastening, leveling tools; maintenance

Construction Materials - Exterior, interior, framing, insulation,
foundations, flooring

Manufactured Items - Windows, stairs, doors, hardware, trim, cabinets,
installation

Remodeling and Maintenance - Painting, paneling, bathrooms, kitchens,
floors, ceilings, storage, waterproofing,
utilities

Careers and Industry - Opportunities, preparation, unions, job
conditions, benefits

TECHNOLOGY SERIES

The *Technology Series* is a group of suggested survey courses designed primarily for conceptual development. These courses open options as electives in Group 3 for students who usually do not take a 3-unit sequence in industrial arts.

GRAPHICS TECHNOLOGY

Publications - 5178

Provides an overview of the visual communication processes with the emphasis on the interface of media, organization, and the printing industry.

- Preparation - Paper, dummy, makeup, bindery, editing, illustrating, photojournalism, pasteups
- Communication Media - Transparencies, copiers, duplicators, screen process, electrostatics, facsimile
- Photography - Cameras, process cameras, films, development, enlarging negatives, photomechanics
- Processes - Offset, gravure, letterpress, composition, phototypesetting, plates, halftones, presses, linecasting, lettercasting, tape, OCR
- Industrial Organization - Guidance, economics, labor, specialties
- Background - History, development, research, field trips

Engineering Drawing - 5180

Surveys the design and descriptive techniques with the emphasis on the graphical systems used to communicate ideas and concepts.

- Language - Scales, graphs, measurement, charts, descriptive geometry, specifications, metrics
- Tools and Techniques - Tools, machines, duplicators
- Shape Description - Oblique, isometric, perspective, orthographic, dimensions, sections, auxiliaries
- Working Drawings - Parts, assembly, exploded, schematic
- Production Processes - Cast, machine, weldments, stampings
- Design Problems - Planning, research, solutions, prototypes, evaluation
- Industry and Careers - Designers, draftsmen, coordinators

PRODUCTION TECHNOLOGY

Construction - 5182

Provides concepts and applications that focus on ecology, community planning, design, and development of structures for both the public and private sectors.

- Developmental Planning - Community services, industrial development, housing, business development density, ecology, transportation

Construction - 5182 (Continued)

Real Estate - Land values, taxes, brokers, economics
Commercial Construction - Steel, frame, masonry block, modular, curtain wall, panel, specifications
Monumental Construction - Public buildings, stadiums, dams, bridges, stone, reinforced concrete, steel, specifications
Home Construction - Modular, manufactured, unitized, on-site, codes
Design - Purpose, interior, exterior, surveying, substructures, superstructures, services, architectural drafting, utilities, site development
Developing Models - Scale, layout, materials, simulations, color, landscape
Industry and Careers - Management, ownership, contractors, unions, trades, collective bargaining, working conditions, safety

Manufacturing - 5184

Integrates the managerial and technical skills, organizational principles, and sectors of production related to manufacturing.

Research and Development - Market research, planning, prototypes
Production Planning - Jigs, fixtures, automation
Plant Organization - Labor, management, job descriptions, responsibilities
Line Production - Scheduling, materials handling, fabrication, assembly
Production Processes - Tools, machines, materials
Financial Control - Capital, credit, accounting, inventory, ownership
Industrial Organization - Economics, field trips, jobs

POWER TECHNOLOGY

Transportation - 5186

Offers an overview of the principles of power, mechanics, hydraulics, and engine operation.

Vehicles - Land, sea, air, cushion
Machines and Power Transportation - Mechanisms, gears, machines, conveyers
Small Engines - Two-stroke and four-stroke cycle, model, kart, outboard, stationary, service, repair, testing
Vehicle Engines - Piston, turbine, sizes, types, fuel, cooling, lubrication, diesel, rotary
Hydraulics - Fluid power systems, control, vacuum, multipliers, applications
Engine Electricity - Batteries, alternators, ignition, test instruments, solid state devices
Careers and Industry - Guidance, manpower, management, production

Aerospace - 5188

Surveys aviation power, propulsion, and control systems as a broad base for career orientation in aerospace industry.

- Vehicles - Planes, helicopters, autogiros, gliders, models, airframes, control surfaces
- Flight - Lift, thrust, drag, airfoils, radio, controlled models regulations
- Piston Engines - Air cooled, water cooled, configurations, superchargers, fuels, dual ignition
- Reaction Engines - Ramjet, turbine, turboprop, compressors, fuels, afterburners, controls
- Rocket Engines - Solid fuel, liquid fuel, multistage, propellants burn rate
- Space Vehicles - Computers, controls, stabilizers, communications, data systems
- Industrial Organization - Aerospace industry, history, guidance

Occasionally, at the local level there is a need to adapt some of the above courses to meet specific conditions. For example, urban children will not be involved in the construction of a home. Therefore, an appropriate alternative course in woods should be developed to meet the local situation. The structures course may be reorganized by focusing on maintenance, repair, alteration, and redecoration for the do-it-yourselfer. In rural areas the structures course might focus on home improvements, layout changes, and renovations within the scope of the students' capabilities and permission to do the work.

School districts also are encouraged to develop unique industrial arts courses that reflect the particular talents or skills of their teachers or are influenced by special community resources or geographic location. Such unique courses may provide unusual opportunities for students in the particular schools. These courses would be identified by one of the following BEDS descriptions: Experimental — 5194, Independent Study — 5196, Other Industrial Arts Courses — 5198.

Industrial arts courses are designed to provide a variety of developmental problem-solving experiences and foster an understanding of the materials, processes, and relationships that exist in industry. Courses that are one semester in length and which avoid rigid prerequisites seem to meet the needs of a wide segment of the school population.

Program Development

The first step in developing or revising a local program of industrial arts is to review the purposes and goals of the local school system. Then, review the purposes and goals established for industrial arts at the local level. When necessary, bring these local industrial arts purposes and goals in line with the school's stated purposes and goals and then update them according to the current recommended guidelines for industrial arts. To assist in the development of local purposes and goals, use the brochure published by the Bureau of Industrial Arts Education entitled, *Industrial Arts Education, Purpose and Principles*.

Next, select the various courses that will comprise the local program of industrial arts. The total program should have enough variety to interest *all* boys and girls in the secondary school. Even schools with only one industrial arts facility can offer a selection of courses because most general-purpose shops have at least four areas which can be utilized for additional courses. Providing in-depth electives for some students is discriminatory toward the larger group. Adaptability rather than skill training should be the goal of all industrial arts courses. Thus, courses that serve the general student body should have priority over specialized courses that serve only a small number of students.

The variety and type of equipment available and the size of the facilities realistically will affect the local program. However, the program needs and purposes should receive priority, and, as soon as possible, the equipment and facilities should be altered to reflect the needs identified in the content outline. See the Department's publication, *Secondary Industrial Arts - Tools and Equipment*.

Course Development

The major content headings for 22 industrial arts courses have been identified in the Department's publication, *Secondary Industrial Arts - An Instructional Planning Guide*, and are listed in this publication starting on page 2. When developing local courses of study, the procedures stated below should be followed:

- Select from the above publication, whenever possible, the major headings for each course in the local program
- Develop for each major heading the instructional content that will assist the students to meet the outcomes identified for that course
- Provide about 25 percent of the class time for group instruction, which will allow about 50 presentations for a one-semester course
- Use existing courses of study and text and reference books as additional resources.

The sample course for Wood Products which is included as a part of the publication was developed in this manner. The major headings were found on page 7 of this publication. Outcomes were identified and then content and instructional strategies were selected which would give the students the opportunity to meet the stated objectives. This same process should be followed by districts developing local industrial arts courses that are listed in the *Instructional Planning Guide* or being developed to meet local needs.

Next, develop a teaching guide for each course. The following four-column format may be helpful when developing such a guide:

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
------------	---------------------------	------------------------------	------------------------

A brief explanation of these items is given below. Starting on page 18 is a model of an approved teaching guide for Wood Products which incorporates this format.

Objectives: State in terms of what the students will be able to do when they apply the skills and knowledge acquired after a specific period of instruction. Stating the objective in terms of what the student will achieve as a result of instruction rather than what the instructor will be doing requires more effort but the results are worth it. This method emphasizes that instruction has no value unless the students are learning.

Include only one specific skill or knowledge for each objective. Start each objective with an action verb which describes an activity that readily can be evaluated. Select concise descriptors such as construct, list, show, explain, write, define, repair, replace, install, select, or demonstrate.

Avoid such words as appreciate, understand, enjoy, know, learn, comprehend, recognize, or become acquainted with because they are open to many subjective interpretations.

Each objective is assumed to be prefaced with the statement:
"After completing this unit, a student will be able to: .."

A further refinement in the writing of objectives would be changing the general objective into a performance objective by adding conditions and standards. The conditions state the circumstances under which the performance or activity will occur. The standards define the minimum performance that is acceptable or state the method by which the performance is evaluated. At the outset of instruction, the students should know what performance is expected of them, as well as the conditions and standards.

Instructional Suggestions: Give specific teaching methods which will assist in presenting the required content necessary to accomplish the stated objective. The statements are addressed to the instructor and start with an action verb. They should be innovative and appropriate for each learning situation. Do not use one method (explain, demonstrate, discuss) to the exclusion of other methods. Be specific and complete with the instructions. List appropriate charts, films, filmstrips, or transparencies. Be sure the materials that are listed are of the latest editions. In the developmental process, design more than one approach to accommodate individual differences and/or variations in class needs.

Student Learning Experiences: Give specific experiences that will help the student develop the required skills and knowledge. These experiences should provide the students with opportunities to practice the skill or use the knowledge being learned. Start each statement with an action verb and have complete sentences. Provide more than one experience to accommodate different learning abilities.

Evaluative Suggestions: Include specific activities that will enable both the instructor and the student to identify the extent to which the student has achieved the prescribed performance objective. These suggestions should not be a rewording of the objective, but an identification of activities that the student can do which will demonstrate his/her ability to perform the skill or use the knowledge that has been learned. The suggestions should be varied and provide alternative modes of assessing the student's competency.

Program and Course Approval

The next step is to apply to the State Education Department for approval for State Diploma credit for the total program and/or individual courses. Complete the form, "Application for Approval of Courses for State Diploma Credit," for the total local industrial arts program and forward to the Bureau of Occupational Education Curriculum Development, State Education Department, Albany, New York 12234. Schools using the Woods Products course as outlined in this publication need not apply for course approval. As developed, this one-semester course carries one-half unit of State Diploma credit.

The following is offered as a guide for the materials that should accompany the application for approval signed by the principal:

Completed Application for Approval of Courses for State Diploma Credit

Contents page

Aims for the local program of industrial arts

Program description

Give a brief overview of the total industrial arts program for the school district. This should be in terms of opportunities provided the students, and reflect the local purposes and goals developed for industrial arts. Include a list of courses that comprise this total industrial arts program.

Individual course information

The following format may be used for each course in the program.

Course title

Course length

The one-semester course appears to meet the needs of most students who would benefit from taking instruction in industrial arts.

Grade level

The secondary level courses in industrial arts should be open to all students in grades 9-12.

Prerequisites

There should be no prerequisites. Each course should be free standing.

Course description

Describe the course in terms of student activities and learnings. This description should be in agreement with the goals and purposes identified in the first step of program development. (See page 10)

Content outline

List, in outline form, the content that will be included in the course. Major content headings for specific courses are found in the Department's publication entitled, *Secondary Industrial Arts: An Instructional Planning Guide*. The specific topics that are developed under the major headings will reflect local adaptations to specific needs. The total number of lessons may vary for different courses but there should be approximately 50 lessons for a one-semester course.

Each course should include an introductory unit encompassing purposes, outcomes, class organization, and general safety practices.

References and resources

Books

List, in alphabetical order by author, at least 10 appropriate titles that are in the facility where the instruction is given and available for student use. These books should be the latest edition and in no case more than 10 years old. For sources of books refer to, *School Shop; Man, Science, and Technology; Industrial Education*; other educational journals, and publishers' catalogues.

Films, filmstrips, loops, and transparencies

List in alphabetical order by titles appropriate items. For sources of audiovisual aids for industrial arts refer to:

NICEM Index to Vocational and Technical Education - Multimedia, 3d ed. 1977,

published by:

National Information Center for Educational Media

University of Southern California

University Park

Los Angeles, California 90007

Educators Guide to Free Films, latest edition

Educators Guide to Free Filmstrips, latest edition

Educators Guide to Free Guidance Materials, latest edition

The above three guides are published by:
Educators Progress Service, Inc.
Randolph, WI 53956

Equipment list

Include only the tools, equipment, and furniture that will be used to implement the instruction for this course. Refer to the Department's publication, *Secondary Industrial Arts, Tools and Equipment* for suggested items.

Shop layout

Submit a scale drawing (1/8" = 1'), reduction of a professional print, or a good photograph showing the location of equipment, furniture, aisles, and storage areas of the shop where the proposed instruction will be given.

Lesson schedule

Develop a sequence of the lessons that will be given during the semester. This is an effective way to provide a workable teaching plan. A weekly grouping of several lessons is an appropriate method to use.

SAMPLE OF INDIVIDUAL COURSE INFORMATION

Title: Wood Products — 5168

Length: 18 weeks; 5 periods per week

Grade Level: Students in grades 9-12

Prerequisites: None

Course Description:

Wood Products is a basic course designed to provide students with the opportunity to use hand and power tools to build and shape new articles of wood and/or repair and reconstruct existing wood items. In the process, students will design and plan carefully, follow methodical work procedures, use suitable fasteners, select appropriate assembly methods, and protect and beautify surfaces with proper finishes. The students also will become familiar with the processes used in converting living trees into materials related to woodworking and gain some knowledge about how these products are used in building and repair work.

Content Outline:

Course Orientation — 1-2 lessons

- Purposes

- Outcomes

- Class organization

 - Plan sheets

 - Notebook

 - Evaluation

 - Cleanup procedures

- General safety practices

Design and Planning — 4-6 lessons

- Design factors

- Reproduction of designs

- Product design

- Project selection

- Project planning

Tools and Machines — 9-11 lessons

- Safe work procedures

- Measuring

- Laying out

- Cutting

- Shaping

- Cutting holes

- Fastening

- Sanding

- Tool maintenance

- Sequencing hand and machine tool operations

- Tools for home workshop

Assembly — 9-11 lessons

 Joints

 Butt, rabbet, dado, lap, miter, mortise and tenon, and dovetail

 Bonding agents

 Bonding of wood

 Clamps

 Jigs and fixtures

Fasteners — 4-6 lessons

 Types of nails

 Fastening with nails

 Types of wood screws

 Fastening with wood screws

 Special fasteners

Finishes — 4-6 lessons

 Purposes

 Classification

 Solvents

 Application

 Surface preparation

 Safe work procedures

Forestry — 9-11 lessons

 Nature of wood

 Classification

 Products of the forest

 Production of lumber

 Production of sheet materials

 Making of paper

 Other wood products

 Recreational use of forest lands

 Research

 Conservation of the forests

 Legislation

Industrial Organizations — 4-6 lessons

 Wood products industries

 Consumer information

 Labor-management relations

 Job information

TEACHING GUIDE

WOOD PRODUCTS DESIGN AND PLANNING

Lessons 4-6

The design and planning process affects many of the products that are used in our daily living. In the development of an item, effort is put forth so the final marketable product will do a particular job for a specified length of time, be made of suitable materials, and whenever possible, be pleasing to look at. Knowing about and being able to recognize certain design factors will assist one to become a more knowledgeable and satisfied consumer. The projects that are planned and built in the industrial arts program should reflect the same design considerations that are involved in the development of a commercial product.

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
Student will be able to:	<i>Design Factors</i>		
18 Explain how different design factors are used in the development of a product made of wood.	Discuss and give examples of how design factors affect the development of a product made of wood. Consider such factors as: • Function (practical) • Appearance (aesthetic) • Line • Shape • Proportion • Texture • Color • Balance • Style • Common sizes • Construction (technical) • Materials • Methods • Price	Bring to class examples of wood products and discuss how effectively the different design factors have been used for each. Consider such items as: • Does it work the way it should? • Is it comfortable to hold and use? • Is it pleasing to look at? • Have the right materials been used in its construction?	From a collection of wood products or pictures of such products, select five and indicate why each could or could not be considered well designed.

Discuss and show examples of the different styles and qualities of furniture commonly available in stores today.

Bring to class pictures of furniture and list the style characteristics of each.

From a collection of pictures of styles of furniture, name four styles commonly found in stores today.

Bring in descriptions from various advertisements and/or catalogs of similar pieces of furniture and indicate the factors that contribute to a "quality" item.

List the quality factors to consider when selecting a piece of furniture.

Arrange a field trip to an area wood products manufacturing plant to see how design factors affect the manufacturing process.

Report on a visit to a wood manufacturing plant and indicate how design features affected the production process.

Invite a local manufacturing plant's designer to discuss how design factors affect the final product that is selected for production.

Report on the main points presented by the speaker relative to how design factors affect the final product that is selected for manufacture.

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Report on at least one occupation related to the field of planning and design

Discuss several occupations related to design and planning, such as industrial designer, industrial engineer, civil engineer, architect, draftsman, detailer, tracer, and material coordinator. Consider such items as requirements, entry-level jobs, duties, salaries, advancement, and outlook.

List five occupations related to design and planning.

Bring to class descriptions of job opportunities that exist in the field of design and planning.

Write a brief report about an occupation related to the field of planning and product design including requirements, entry-level jobs, duties, salaries, advancement, and outlook.

Objectives

Instructional Suggestions

Student Learning Experiences

Evaluative Suggestions

Reproduction of Designs

Reproduce, enlarge, or reduce designs using:

- Proportional squares
- Opaque projector
- Templates

Demonstrate how to reproduce, enlarge, or reduce a design using:

- Proportional squares
- Opaque projector
- Templates

Reproduce curved lines and designs to the desired size when they are part of a project.

Explain two methods that may be used to reproduce designs for a project.

Product Design

Explain the process involved in designing a product.

Discuss the process used to design a product. Consider such steps as:

- Stating the problem
- Analyzing and researching the problem
- Listing possible solutions
- Selecting a final solution

Show how the above process can be used to develop a design for a project.

Discuss the several steps involved in designing and developing a product.

Project Selection

Select projects that:

- Meet his or her needs
- Is within his or her ability

Indicate that the purpose of building a project involves such learning experiences as developing the ability to:

- Use an organized approach to solve a problem

Look through reference materials available and select or adapt several appropriate projects. Discuss with the instructor the final choice of each project.

Explain why a particular project was selected considering needs, ability, equipment and materials available, and design factors.

- Is made with and from existing equipment and materials
- Contain the elements of good design

- Make necessary sketches and drawings
- Identify tasks needed to build an article
- Perform the tasks in an acceptable manner
- Develop safe work habits

Discuss with students their individual choices of projects and help them identify and solve any related problems. The final choice of any project is to be made by the student.

Reference materials from which students may select appropriate projects are provided to accommodate three types of students, those who:

- *Are able to originate and conceive an idea, evolve the necessary two-dimensional plans, and then produce a three-dimensional article*
- *Can take a two-dimensional plan, adapt it when necessary, and produce a three-dimensional article*
- *Need a three-dimensional object to use as a model or sample **

*The italicized statements that appear in this column throughout the teaching guide are supplemental concepts, activities, and/or suggestions made by the teacher to indicate how the specific materials are to be used or presented.

Objectives

Instructional Suggestions

Student Learning Experiences

Evaluative Suggestions

Project Planning

Follow the required steps to plan a project including:

- Making a sketch or working drawing to the desired detail and scale
- Selecting appropriate materials
- Making a bill of materials
- Locating prices and computing costs (board foot)
- Listing, in order, the steps necessary to build the project

Discuss the importance of planning before starting to work.

Discuss and demonstrate the procedures for planning a project by making a:

- Working drawing or detailed sketch (orthographic, isometric, cabinet oblique)
- Bill of materials including all costs (bd. ft. computations)
- Plan of procedures to build project (pattern development, gluing, use of jigs and fixtures, subassemblies, final assembly, sanding, and finishing)

Make for each project an acceptable:

- Sketch or drawing
- Choice of materials
- Bill of materials including all costs
- List or plan of procedures needed to build project

For each project, submit to the instructor for approval a:

- Sketch or drawing
- Choice of materials
- Bill of materials including all costs
- Plan of procedures needed to build project.

TOOLS AND MACHINES

Lessons 9-11

Wood is shaped easily with hand and/or machine tools, and working with this material provides enjoyment and satisfaction to many people. When building with wood, it is important to know how to select tools and/or machines for specific operations and then to use them safely.

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
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Due to the flexibility inherent in our program where we utilize self-standing, one-half unit courses, the specific tool and machine demonstrations and related activities presented will depend upon the needs and backgrounds of the students in the individual classes.

The selected demonstrations are given over a period of time. Each one is presented just before the information is needed by the students, and is supplemented with related films, loops, slides, or overhead transparencies.

Some students are permitted to try each process demonstrated and corrections are made when needed. Students are questioned to be sure they fully understand the material presented.

Student will be able to:

Safe Work Procedures

Demonstrate by daily behavior the safe work procedures to follow when using tools and machines.

Discuss the general safety procedures to follow when working in the shop. Consider such items as:

List the general safety procedures to follow when working in the shop.

Follow general safe work procedures when using tools and machines.

Objectives

Demonstrate by daily behavior the safe work procedures to follow when using tools and machines.

Instructional Suggestions

- Clothing
- Rings
- Eye protection
- Lifting and carrying materials
- Hand protection
- Tools-use, handles, sharpness, and carrying
- Electrical cords and plugs
- Use of push sticks and guards

Safe work procedures are included in all lessons to foster the development of the students' safety consciousness.

Student Learning Experiences

Evaluative Suggestions

Come to class each day dressed for work.

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Measuring

Make measurements that are accurate to plus or minus one millimeter or one-thirty-second of an inch.

Discuss the importance of making measurements that are accurate to at least one millimeter or one-thirty-second of an inch.

Demonstrate the reading of a rule using both the metric and customary (English) systems of measurement. Compare rather than convert from one system to the other.

Demonstrate how to make accurate measurements.

Practice making measurements that are accurate to specific tolerances.

When building projects, make measurements that are accurate to plus or minus one millimeter or one-thirty-second of an inch.

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- 2 Develop measuring problems for students' practice involving both metric and customary systems of measurements.

Project plans with metric dimensions will be available for student use.

Solve measuring problems.

At least 90 percent of the solutions to the measuring problems are within the specified tolerances.

Laying Out

Select layout tools designed for the specific layout situation.

Mark parts on stock to plus or minus one millimeter or one-thirty-second of an inch and positioned to save material and cutting time.

Demonstrate how to draw parts on stock using such layout tools as:

- Rule and tape
- Squares
- Dividers and trammel points
- T-bevel
- Marking gauge
- Pencil and knife

Show how to place individual parts on stock considering the direction of grain and following procedures that save materials and cutting time.

The accuracy of each student's layout work is checked before he/she is allowed to cut the stock.

Use layout tools to draw parts on selected materials accurately and without excessive wastage.

Explain why the grain direction must be considered when laying out parts on stock.

When constructing projects, place parts on stock to plus or minus one millimeter or one-thirty-second of an inch and positioned in such a way as to save material and cutting time.

Check the accuracy of each student's work before he/she cuts the stock.

Objectives

Locate specific points on stock for holes, joints, and/or internal openings being accurate to plus or minus one millimeter or one-thirty-second of an inch.

Instructional Suggestions

Demonstrate how to locate specific points on individual parts for holes, joints, and/or internal openings.

Student Learning Experiences

Locate specific points, accurately on individual parts for joints, and internal openings.

Evaluative Suggestions

When constructing projects locate points for holes, openings, and/or joints to within plus or minus one millimeter or one-thirty-second of an inch.

Cutting

Select the handsaw designed for the specific cutting situation.

Use handsaws safely to cut stock to the tolerances required for the task.

Demonstrate where and how to use such handsaws as:

- Rip
- Crosscut
- Back
- Coping
- Compass

Discuss the difference between rough and finish cuts and the saws, points per inch, and tolerances required for each.

Cut stock using the correct handsaw for each specific situation.

List basic operations performed by the rip, crosscut, back, coping, and compass saws.

From a list of cutting situations, name the handsaw to use for each.

From a collection or pictures of saws, name correctly and give two uses for each.

Explain, using charts, the difference between the cutting action of a rip saw and a crosscut saw.

Give two examples each of rough and finish cuts.

Name the saw needed to cut a piece to exact length and give reasons for the selection.

When constructing projects use the correct handsaw for specific cutting situations and be accurate to within the tolerances required for the task.

Select the power saw designed for the specific cutting situation.

Use power saws safely to cut stock to the tolerances required for the task.

Demonstrate how to cut stock using such power saws as:

- Scroll saw
- Band saw
- Table saw
- Radial arm saw
- Saber saw
- Portable circular saw

Demonstrate the specific safety procedures to follow when using each machine.

Demonstrate additional operations that may be performed with each power saw.

Prepare a safety test for each power saw and have a satisfactorily completed one on file for each student before he/she operates the machine.

The student's operation of each power saw is checked the first few times to determine that he/she is following correct operating procedures.

Complete satisfactorily the safety test for each power saw prior to using it in class.

List basic operations performed on each power saw.

Check each power saw carefully before operating it.

Cut stock using a variety of power saws.

Change saw blades on any of the power saws when necessary.

List the safety procedures to follow when using each of the following power saws: scroll, band, table, radial arm, saber, portable-electric.

From a list of cutting situations, name the power saw to use for each.

From a list of five power saws, select three and explain how to set up and use each for at least two specific cutting situations.

List at least one special operation that can be performed on the following power saws: scroll, band, table, radial arm, saber, and portable.

When constructing projects use safely the correct power saw for specific cutting situations and be accurate to the tolerances required for the task.

Objectives

Select the hand tool designed for the specific shaping situation.

Use shaping tools safely for specific operations to the tolerances required for the tasks.

Instructional Suggestions

Demonstrate how to shape stock using such hand tools as:

- Planes
- Spokeshave
- Chisels and gouges
- Files, rasps, and "surform" tools

Student Learning Experiences

Shaping

Shape stock safely using the correct plane for each specific situation.

List uses for each hand plane found in the shop.

Adjust hand planes for specific shaping situations.

Shape stock safely using chisels and gouges.

Shape stock safely using files, rasps, and/or "surform" tools.

Evaluative Suggestions

From a collection or pictures of hand shaping tools, name correctly and give two uses for each.

From a list of shaping situations, name the hand tool to use for each.

Explain the differences among files, rasps, and "surform" tools and give two uses for each.

When constructing projects, use the correct shaping tool for specific situations to the tolerances required for the task.

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Select the power tool designed for the specific shaping situation.

Use power tools safely to shape stock to the tolerances required for the task.

Demonstrate how to shape stock using such power shaping machines as:

- Jointer or "uniplane"
- Router
- Shaper
- Wood lathe
- Rotary hand tool

Demonstrate the specific safety procedures to follow when using each power shaping machine.

Complete satisfactorily the safety test for each power shaping machine prior to using it in class.

Shape stock using a variety of power shaping machines.

List the basic operations performed by each power shaping machine found in the shop.

Change cutters on the router.

Do spindle and faceplate turning on the wood lathe.

List the safety procedures to follow when using the following power shaping machines: jointer or "uniplane", router, shaper, and wood lathe.

From a list of shaping situations, name the power tool to use for each.

Demonstrate additional operations that may be performed with each power shaping machine.

Prepare a safety test for each power shaping machine and have a satisfactorily completed one on file for each student before he/she operates the machine.

The students' operation of each power shaping machine is checked the first few times to determine that he/she is following correct operating procedures.

From a list of five power shaping machines, select three and explain how to set up and use each for at least two specific shaping situations.

List at least one special operation that can be performed with each of the following power shaping machines: jointer, uniplane, router, shaper, and wood lathe.

When constructing projects, use safely the correct power shaping tool for specific situations.

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Cutting Holes

Select the hand tool designed to cut holes for the specific situation.

Use hand tools safely to drill and/or bore holes in stock.

Demonstrate how to cut holes in stock using such hand tools as:

- Hand drill and twist drill
- Brace and auger bit
- Brace and expansive bit

Cut holes safely using the correct hand tool for each specific situation.

From a list of dimensions under one inch, indicate the number of the auger bit needed to bore each hole.

From a collection or pictures of hand tools used to cut holes in stock, name correctly and give at least one use for each.

From a list of auger bit numbers, give the size hole each will produce.

From a plan that requires various sized holes from one-quarter of an inch to two and one-half inches in diameter, name the

Objectives

Use hand tools safely to drill and/or bore holes in stock.

Select the power tool designed to drill holes for the specific situation.

Use power tools safely to cut holes in stock.

Instructional Suggestions

Demonstrate how to cut holes in stock using such power tools as:

- Drill press
- Portable power drill

Demonstrate the specific safety procedures to follow when using each machine.

Demonstrate the use of attachments and jigs and fixtures for the drill press to do specific operations such as:

- Drilling duplicate holes
- Mortising

Prepare a safety test for each power tool used for cutting holes in stock and have a satisfactorily completed one on file for each student before he/she operates the machine.

The students' operation of each power tool used for cutting holes is checked the first few times to determine that he/she is following correct operating procedures.

Student Learning Experiences

Complete satisfactorily the safety test for each power tool used for cutting holes in stock prior to using it in class.

Cut holes in stock using power drilling tools.

Set up and perform special drilling operations using the drill press.

Change speed of drill on the drill press by changing the belt.

Evaluative Suggestions

proper hand tool and bit or drill to use to cut each hole.

Use the appropriate tools to cut holes when they are needed in a project.

List the safety procedures to follow when using power tools for cutting holes.

Design and use a jig and/or fixture for a special drilling situation.

From a list of four special drilling situations, select two and explain how to set up and use each one selected.

List two special operations that may be performed on the drill press.

When constructing projects, use safely the power tools designed for cutting holes.

Fastening

Select a claw hammer of the weight appropriate for his or her stature and the task.

Use a claw hammer safely to drive, set, and draw nails without marring the surface.

Discuss how claw hammers are sized and uses for each.

Discuss the different types of claw hammers and uses for each.

Demonstrate how to drive, set, and draw nails with a claw hammer without marring the surface.

Indicate when the following are better than a hammer for taking apart items fastened with nails:

- Wrecking bar
- Nail claw
- Ripping chisel

Select a screwdriver appropriate for the task.

Use a screwdriver safely to install and remove screws without marring the surface.

Discuss the different types of slotted and Phillips-head screwdrivers and uses for each. Include such types as:

- Regular
- Offset
- Automatic
- Bit

Demonstrate how to use different types of screwdrivers to install and remove screws without marring the surface.

Use a claw hammer to drive nails when they are used to fasten together parts of a project.

Use a screwdriver to install screws when they are used to fasten together parts of a project.

Explain how claw hammers are sized and uses for each.

Explain how to draw a long nail from stock.

When nails are used in the construction of projects, select the appropriate claw hammer and drive and set nails without marring the surface.

Explain how to select a screwdriver for a given situation.

When screws are used in the construction of projects, select the appropriate screwdriver and install the screws without marring the surface.

Objectives

Instructional Suggestions

Student Learning Experiences

Evaluative Suggestions

Sanding

Select the coated abrasive designed for the specific sanding situation.

Discuss the selection of coated abrasives for specific sanding situations. Consider such items as:

- Kind of abrasive material
- Grit size
- Backing
- Bond or adhesive
- Method of coating
- Form

Demonstrate how to sand stock by hand for various situations.

Sand stock using hand methods.

From a list of five different grit sizes, arrange them in order, progressing from coarse to fine, and give at least one use for each grit.

From a list of sanding situations, give the coated abrasive to use for each.

When constructing projects, use the correct coated adhesive for each specific sanding situation.

32 Select the power sander designed for the specific sanding situation.

Use power sanders safely to sand stock.

Demonstrate how to sand stock using such power sanders as:

- Belt
- Disk
- Portable belt
- Portable finishing

Demonstrate the specific safety procedures to follow when using for each power sander.

Prepare a safety test for each power sander and have a satisfactorily completed one on file for each student before he/she operates the machine.

Complete satisfactorily the safety test for each power sander prior to using it in class.

Sand stock using power sanders.

List the basic operations performed by each power sander.

List the safety procedures to follow when using each of the power sanders found in the shop.

From a list of sanding situations, indicate the power sander to use for each.

When constructing projects, use safely the power sanders for specific sanding situations.

The student's operation of each power sander is checked for the first few times to determine that he/she is following correct operating procedures.

Tool Maintenance

Perform routine maintenance operations safely on common hand and power tools.

Discuss the importance of maintaining hand and power tools in good operating condition and protecting them from rust. Emphasize the advantages of preventative maintenance.

Demonstrate how to sharpen hand tools with a file and/or grinder. Include such hand tools as:

- Chisels
- Plane irons
- Screwdrivers
- Twist drills
- Auger bits
- Wood lathe tools

Emphasize the importance of keeping the cutting edge cool during the grinding process.

Prepare a safety test for the grinder and have a satisfactorily completed one on file for each student before he/she operates the machine.

Complete satisfactorily the safety test for the grinder prior to using it in class.

Bring tools from home, with parents approval, for sharpening and/or handle replacement. Protect tools at home from rust.

List the safety procedures to follow when using the grinder.

When using the grinder, follow safe procedures.

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
Perform routine maintenance operations safely on common hand and power tools.	<i>The student's operation of the grinder is checked for the first few times to determine that he/she is following correct operating procedures.</i> Demonstrate how to clean and recondition hand tools. Show also how to protect tools from rust. Demonstrate the procedure for replacing a hammer handle. Demonstrate how to perform routine maintenance for portable power tools. Include such items as: • Checking cords and plugs • Cleaning • Adjusting • Lubricating • Changing brushes • Checking belts <i>Students are instructed to report immediately any tool that is dull, broken, or defective and/or any power tool or machine that is not operating correctly or has a damaged or defective cord and/or plug.</i>	Bring portable power tools from home, with parents approval, and perform routine maintenance or make minor repairs. List maintenance checks required for portable power tools. Prepare personal portable power tools for storage.	Explain the routine maintenance that is required of most power machines and portable power tools. Use only machines and portable power tools that are in good working condition. Follow safe work procedures when doing routine maintenance on portable power tools brought from home.

Sequencing Hand and Machine Tool Operations

Analyze and sequence the hand and machine tool operations required for the construction of any project.

Show how to analyze and sequence the hand and machine tool operations required to build specific projects.

Emphasize the importance of having all materials securely fastened when working with portable power tools.

Make a list of common wood-working operations and after each one indicate the possible hand tools, portable power tools, and/or power machines that will perform each operation.

List the general safety procedures to follow when using any of the hand tools.

List the general safety procedures to follow when using any of the power machines.

Obtain the instructor's permission each time a power machine is used.

Determine speeds and make necessary adjustments on any of the power machines based on the operation being performed. Have instructor check all machine setups before they are used.

Make machine changeovers and, perform special operations on any of the power machines.

Review film loops on any tool or machine in order to clarify a point presented in a demonstration.

For a given project or plan, analyze and sequence the hand tools, portable power tools, and power machines required for its construction.

From a list of woodworking operations, indicate the best hand tool, portable power tool, or power machine to use for each.

From a collection or pictures of hand tools, name and give at least two specific uses for each.

From a list of 10 hand tools select eight and give specific safety procedures to follow when using each one selected.

From pictures or drawings of portable power tools, name and give at least two specific uses for each.

From pictures or drawings of power machines, name and give at least two specific uses for each.

Objectives

Analyze and sequence the hand and machine tool operations required for the construction of any project.

Instructional Suggestions

Student Learning Experiences

Clean off sawdust and chips only after machine has stopped. Leave machine ready to be used again.

Evaluative Suggestions

From a list of 10 portable power tools and power machines, select eight and give the specific safety procedures to follow when using each one selected.

Tools for the Home Workshop

Prepare a list of hand and power tools he or she would need for a small home workshop staying within a stated budget.

Develop with the students a list of hand and power tools that would be suitable for a small home workshop. Consider the amount of money such a list of tools and machines represents.

List the hand and power tools available for use at home. Make another list of the tools and machines that might be added, and indicate the operations that could be performed by each hand or power tool added.

From a list of three general activities that are conducted in a home workshop, select one and list the tools and power machines needed.

ASSEMBLY

Lessons 9-11

Many times products made of wood are composed of several parts. These parts are fastened together with a variety of joints and held in place with different glues or adhesives. It becomes important to know the characteristics of these various joints and glues or adhesives in order to make wise choices when constructing projects of wood or selecting an article for purchase.

Objectives	Instructional Suggestions	Student Learning Activities	Evaluative Suggestions
Student will be able to:	<i>Joints</i>		
Name and give two uses for at least eight wood joints commonly used in woodworking.	Discuss, using transparencies and/or actual examples, the names and uses of common wood joints such as: • Butt (dowel, spline, tongue and groove) • Rabbet • Dado (dado-rabbet, groove) • Lap (end, cross, middle) • Miter • Mortise and tenon • Dovetail	Develop a chart that lists common wood joints and uses for each. Survey the home and make a list of the different wood joints found and state where each was used.	From pictures or actual models of 10 common wood joints, correctly name eight and give two uses for each. Explain how the joints used in furniture affect its cost and expected usable life.
	Explain the factors that affect the strength of a joint.	List the factors that affect the strength of a joint.	Explain how to reinforce joints to make them stronger.
Construct different wood joints when required in the building of projects.	Demonstrate how to lay out and construct by hand and/or machine all of the above joints including all safety procedures. Give special construction tips, where applicable.	Practice making various wood joints using hand and machine processes following all safety procedures.	Select two of the following joints and give the steps to make them using a table saw: Rabbet End Lap Dado Miter

Objectives

Construct different wood joints when required in the building of projects.

Instructional Suggestions

Emphasize the fact that it is impractical and costly to use joints which are much stronger than the job requires.

Develop an experiment that compares the relative strengths of the following two groups of joints (well-fitted):

Butt, dowel, spline, and dado
Miter, end-lap, and mortise and tenon

Based on the above results, discuss guidelines for using these joints.

Student Learning Activities

Evaluative Suggestions

When making a mortise and tenon joint, name the part that should be cut first and explain why.

When required in the construction of projects, use different types of wood joints. Show the instructor the joints before they are fastened together and explain why each particular joint was selected.

Bonding Agents

38

Explain the characteristics of glues and adhesives that make them useful as bonding agents.

Explain the bonding of wood. Consider the principles of cohesion and adhesion.

State the characteristics of wood that make glues and adhesive effective bonding agents.

Explain why glues and adhesives are effective when used to hold together wood parts.

Explain the differences between glues and adhesives and give uses for each.

Discuss the properties of bonding agents. Explain the differences between glues and adhesives.

List the distinguishing features of glues.

From a list of 15 glues and adhesives list those that are adhesives and give two uses for each one selected.

Explain the differences between natural and synthetic adhesives and list examples of each.

List the glues available in the shop and indicate the type of each.

Explain the differences between thermoplastic and thermosetting adhesives and list examples of each.

List the distinguishing features of adhesives.

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Select the appropriate glue or adhesive for specific bonding situations.

Develop with the class a chart that lists glues and adhesives and gives the form, working temperature, clamping time, properties of joint, water resistance, uses, and trade names for each.

Make a chart of the names, properties, characteristics, and uses for the glues and adhesives commonly used in woodworking.

From 10 different situations requiring the bonding of wood parts, select eight and give an appropriate bonding agent to use and two reasons for the material selected.

State the glues and adhesives that are available in the shop.

List the glues and adhesives that would be appropriate for a home workshop.

List the types of adhesives to use in situations where heat or moisture is a factor.

Discuss how the moisture content of the wood affects the bonding agent used.

When needed in the construction of projects, select the appropriate bonding agent for each situation.

Explain how temperature affects many adhesives and glues.

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Bonding of Wood

Prepare the individual parts so that a strong glue joint will result.

Explain the factors that affect the strength of a wood joint.

Emphasize the importance of having all pieces and parts free of dust and foreign matter.

Discuss how the level of restriction affects the strength of a wood joint.

Prepare three or four similar wood joints for gluing. Fasten together one joint normally and use it as a control piece. For the other joints apply to the bonding surface small amounts of different types of foreign materials before the gluing. Clamp all joints the same way and allow equal time for curing. Arrange the joints in a vise so that weights (a pail with sand) may be added. Compare the weight needed to cause the control joint to fail with the weights needed to cause the contaminated joints to fail and write a recommendation for the preparation of surfaces for gluing.

Explain the procedures to follow to have a strong glue joint.

Objectives

Prepare the individual parts so that a strong glue joint will result.

Select the appropriate clamp for specific holding situations.

Fasten together a variety of wood parts using the appropriate glue or adhesive and clamps.

Instructional Suggestions

Discuss the advantages of constructing joints with a close fit. Point out that glue will not compensate for a poor fit. Indicate that a good glue joint is usually stronger than the wood itself.

Demonstrate how to prepare surfaces so that a strong glue joint will result.

Discuss the selection of clamps for specific situations including gluing for thickness and width. Consider such items as:

Bar clamps Spring clamps
C-clamps Miter clamps
Hand screws Band clamps

Demonstrate the step-by-step procedures for fastening together a variety of wood parts and joints using different types of glues or adhesives and clamps including all safety precautions. Indicate the importance of making a trial assembly and marking adjacent pieces before applying the bonding agent.

Emphasize the importance of following the manufacturer's instructions when mixing and/or applying a bonding agent.

Explain how to avoid having "starved" joints.

Student Learning Activities

Repeat the above experiment substituting a poorly fitted joint for the contaminated joints.

Based on the results, write a recommendation for the way joints should fit.

List the types of clamps that would be appropriate for a home workshop.

Make trial assemblies before applying bonding agents.

Apply glues and adhesives according to manufacturer's instructions.

Evaluative Suggestions

From a collection or list of seven clamping devices, select five and give two uses for each one selected.

List the steps to follow when gluing several 3" boards edge-to-edge.

Follow safe work procedures when using glues and adhesives.

Show how to use protective blocks under clamp jaws to avoid damaging surfaces.

Explain the importance of checking to determine that the work is flat and/or square after it has been clamped.

Explain the curing of glues and adhesives.

Discuss the electronic curing of certain types of glues.

Show how to wipe off all excess glue or adhesive from work before putting it aside to dry. Include the proper disposal of the bonding agents.

Make the students aware of the hazards of using glues and adhesives that are volatile, quick setting, and/or contain toxic substances. Consider such items as:

- Ventilation
- Eye protection
- Skin protection
- Disposal procedures

Use protective blocks under clamp jaws when gluing stock together.

Check work after it has been clamped to assure it is flat and square.

Bring in sample labels from a variety of glues and adhesives.

List the glues and adhesives available in the school shop and give the protective procedures that are needed when using each glue and adhesive.

Explain how glue dries.

Wipe off excess glue or adhesive from work prior to putting it aside to dry. Put away the bonding agent correctly and leave the work area clean and neat.

Explain the special precaution that persons who wear contact lenses need to take when using volatile glues and adhesives.

Use glues and adhesives safely.

Objectives

Follow safe work procedures when using glues and adhesives.

Use jigs and fixtures for special holding and/or multiple unit situations.

Instructional Suggestions

Emphasize the importance of following the manufacturer's instructions which identify the hazards and the precautions to take when using a specific glue or adhesive.

Discuss and show how jigs and fixtures are used for special holding situations to reduce production time and improve the quality of the final product.

When possible, arrange a visit to a wood products plant to observe the jigs and fixtures and holding devices that are used in the construction process.

Student Learning Activities

Design and use jigs and fixtures for holding pieces during the construction process.

Report on the field trip to a wood products plant.

Evaluative Suggestions

Explain how jigs and fixtures are used to reduce the production time and improve the quality of the final product.

When required, use jigs and fixtures in the construction of projects.

FASTENERS

Lessons 4-6

Mechanical fasteners are used widely in wood construction. Nails are easy to install and are used in general construction where appearance is not important. Screws provide greater holding power and can be removed easily. They require more time to install and are more expensive than nails. Screws are used in quality furniture and in situations where disassembly and reassembly may be desirable.

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
Student will be able to:	<i>Types of Nails</i>		
Name by sight different types of nails and give three examples when each type should be used.	Illustrate the different types of nails. Lead a class discussion on when and why it would be appropriate to use each type of nail. Include such types as: • Common and box • Casing, finishing, and brads • Special purpose	Make a display using actual nails or illustrations of nails to show the different types and list uses for each.	From a collection of nails or illustrations of nails, name the various types and give three examples of appropriate uses for each.
Give four examples of situations when it would be appropriate to use nails as the fastening device.	Discuss the advantages and disadvantages of using nails as a fastener for wood parts.	List five advantages and five disadvantages of using nails as fasteners.	From a list of situations requiring the use of fasteners, select those for which nails would be appropriate.
Purchase the right amount, size, and type of nail for a specific job.	Discuss with the class the penny system and how nails are sized and purchased.	Make a visual aid that shows how the penny system relates to the length of nails.	For three projects or jobs suggested by the instructor, write a purchase order for the required types, sizes, and amounts of nails for each project or job.

Objectives

Instructional Suggestions

Student Learning Experiences

Evaluative Suggestions

Fastening with Nails

Select the appropriate nail and method of nailing for given situations.

Use nails to fasten together parts without splitting the stock.

Demonstrate different methods of nailing and indicate why and when each method would be appropriate.

Devise experiments to help students develop the ability to select the appropriate type of nails and method of nailing.

Consider such factors as the determination of the relative pressure needed to withdraw, with a hammer, different types of nails when driven by the same nailing method into similar materials.

Explain the situations that require the use of pilot holes when fastening parts with nails.

Perform one or more experiments to assist in developing the ability to select the appropriate type of nail and method of nailing for specific situations.

Become involved with projects or situations that require the use of different types of nails and methods of nailing.

For three projects suggested by the instructor, describe how the parts should be fastened using nails. Indicate the reasons for using the specific types of nails and the nailing pattern in each situation.

When nails are required in the construction of projects or in other situations, select the appropriate type and method of nailing and perform the work in a manner that is acceptable to the instructor.

Types of Wood Screws

Name by sight different types of wood screws and state when and why each type should be used.

Give examples of situations when it would be appropriate to use wood screws as the fastening device.

Illustrate the different types of heads, slots, and finishes common to wood screws. Lead a class discussion on when and why it would be appropriate to use each type of wood screw.

Discuss the advantages and disadvantages of using wood screws as fasteners.

Make a display using actual wood screws or pictures of wood screws to show the different types and uses for each.

List five advantages and five disadvantages of using wood screws as fasteners.

From a collection of wood screws or pictures of wood screws, name the various types and give three examples of appropriate uses for each.

From a list of situations requiring the use of different types of fasteners, select those for which wood screws would be appropriate.

Purchase the right amounts, sizes, and types of wood screws for specific situations.

Discuss with the class how different types of wood screws are sized and sold.

Make a chart that shows how wood screws are sized and purchased.

From three projects or situations suggested by the instructor, write a purchase order for the required types, sizes, and amounts of wood screws for each project or situation.

Fastening with Wood Screws

Select the appropriate wood screws for given situations.

Prepare individual parts to be fastened together with wood screws.

Use wood screws to fasten together parts and/or attach hardware without splitting the stock.

Demonstrate how to select and use different types of wood screws to fasten together parts made of soft and hard textured woods, and in end grain without splitting the stock. Include such items as:

- Layout of holes
- Use of size chart
- Size of shank hole
- Size of pilot hole
- Drill holes by hand and power
- Countersink and/or countersink and counterbore
- Use of combination drill and countersink for wood screws
- Size and type of screwdriver to fit screw head and slot
- Use of plugs to cover screw heads

Compare the time and skill required to achieve comparable accuracy when making holes for a flat head wood screw using drills and a countersink and using a combination drill and countersink for wood screws. Based on the information gathered, list the precautions one should take when using separate drills and a countersink to make holes for wood screws. Also, list the advantages and disadvantages of using the combination drill and countersink for wood screws.

Fasten some parts with nails and similar parts with wood screws and subject all the parts to tests for holding power, ease of assembly and disassembly, and permanency. Based on the information gathered, list the advantages of both wood screws and nails as fastening devices. Also, list five appropriate applications for nails and five for wood screws.

Given five screw gauge numbers, select the correct size shank and pilot hole drills for each.

For three projects suggested by the instructor, describe how the parts should be fastened using wood screws. State the reasons for using the specific type of screw in each situation.

When wood screws are required in the construction of projects or in other situations, select the appropriate type and perform the work in a manner that is acceptable to the instructor.

Objectives

Name by sight eight special fasteners and give appropriate uses for each.

Instructional Suggestions

Show and discuss the uses, in the construction of wood products, of such special fasteners as:

- Hanger bolts
- Stove and carriage bolts
- Screw hooks
- Lag screws
- Corrugated fasteners
- Staples
- Upholstery nails and tacks
- Mending and attaching plates
- Hinges

Demonstrate how to install the above special fasteners.

Student Learning Experiences

Special Fasteners

Make a display that includes as many special fasteners as possible, listing name, size, and major use for each fastener.

Evaluative Suggestions

From a collection of 10 special fasteners, name eight and list the names and major uses of each.

For a project suggested by the instructor, indicate the special fastener or fasteners needed and describe how they should be applied.

When special fasteners are required in the construction of projects or in other situations, select the appropriate one and perform the work in a manner that is acceptable to the instructor.

FINISHES

Lessons 4-6

Wood is a porous and absorbent material. Unfinished wood tends to absorb moisture and fumes which may cause it to swell, shrink, check, warp, or discolor. Finishes reduce these tendencies by providing a protective coating which helps to stabilize the condition of the wood and improve its appearance.

Finishing is a major process and it is usually the final step in the manufacture of a product. Finishing may emphasize minor blemishes in a surface, therefore, a finish is no better than the surface to which it is applied. Finishing is the application of stains, filler, varnishes, paints, oils, and waxes. They are applied by brushing, dipping, spraying, wiping, rubbing, and rolling.

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
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Student will be able to:

Purposes

Explain why finishes are used on wood products.

Show products or panels of various types of finishes and discuss their purposes. Consider such items as:

- Preserving
- Beautifying
- Increasing value

Bring in five different wood products or pictures of wood products and indicate the type of finish that each should have.

Give three reasons for applying finishes to wood products.

Classification

List different classes of wood finishes and give the characteristics and uses for at least three in each classification.

Discuss, using charts or overhead transparencies, the different classes of wood finishes and the characteristics and uses for each. Consider such factors as:

- Clear
 - Surface
 - Varnish
 - Lacquer
 - Shellac
 - Polyurethane
 - Wax
 - Penetrating
 - Linseed oil and turpentine

Prepare a chart that lists popular finishes with headings such as type, how applied, drying time, uses, and advantages and disadvantages.

From a list of eight finishes, select six and describe their characteristics and uses.

Objectives

List different classes of wood finishes and give the characteristics and uses for at least three in each classification.

Instructional Suggestions

- Opaque finishes
 - Paints
 - Water base
 - Oil base
 - Varnish base
 - Stains
 - Water base
 - Alcohol base
 - Oil base

Student Learning Experiences

Evaluative Suggestions

Prepare wood surfaces for finishing or refinishing.

Discuss and demonstrate the procedures to follow and materials to use to prepare wood surfaces for finishing or refinishing. Include such items as:

- Removing old finish
- Repairing surface defects
- Smoothing surface (hand and machine sanding)
- Filling open grained woods
- Safety procedures

Demonstrate hand and power sanding techniques for flat, curved, and irregular shaped objects.

Show samples of product parts or wood panels that have been prepared poorly prior to finishing. Discuss procedures that should have been followed in order to produce a quality finish in each case.

Surface Preparation

Bring to class a small wood article that is in need of refinishing. Remove the old finish, repair any defects, and prepare the surface for a new finish.

Test and compare various materials used to remove finishes, repair surface defects, and fill open grained woods for:

- Ease of application
- Time involved
- Effectiveness
- Cost

Review with the instructor the condition of the article before refinishing it.

List the steps needed to prepare wood surfaces for finishing.

From a collection of product parts, select the ones that have been prepared properly for finishing or refinishing. Then, list the necessary corrective procedures for the other parts.

Prepare project parts for finishing.

Application

Apply appropriate finishes to different types of wood products.

Demonstrate several methods of applying various types of finishes to different species of wood. Consider such methods as:

- Brushing
- Spraying
- Rubbing on
- Dipping
- Rolling

Discuss the advantages and disadvantages of each method of application. Consider such things as:

- Ease of application
- Ease of cleanup
- Drying time
- Cost

Use audiovisual aids to illustrate the techniques of wood finishing.

Prepare various wood samples with different finishes following manufacturer's specifications and using several methods of application. Check makers' claims against the actual results including resistance to abrasions, scratches, dents, heat, and household detergents. Based upon the results, make a chart showing the best uses for different finishes along with the appropriate methods of application.

Bring to class newspaper ads showing prices of both finished and unfinished furniture. Compare prices considering time, cost of the finish, and time involved in applying the finish.

Outline the procedures given in the audiovisual aid for finishing a wood product.

Study labels on containers of various types of finishes. Make a chart showing the methods of application recommended by the different manufacturers.

Explain the choice of a particular finish and method of application for a specific project.

From a list of seven wood products, select five and explain the type of finish that would be appropriate and describe the procedures for application for each product.

Explain why different methods of application are necessary for different types of wood finishes.

Apply finishes to projects using the best method of application and in a manner acceptable to the instructor.

Objectives

Instructional Suggestions

Student Learning Experiences

Evaluative Suggestions

Solvents

Use appropriate solvents for different types of wood finishes.

Discuss and demonstrate the solvents to use with different types of wood finishes. Include safety procedures to follow when handling solvents.

Prepare a chart that shows the solvent to use with each of wood finishes found in the shop.

From a list of finishes, name the solvents to use with each.

Use the appropriate solvent when cleaning up after finishing a project or part of a project.

Safe Work Procedures

Follow safe work procedures when using, cleaning-up, discarding, and storing wood finishing materials.

Demonstrate and explain the methods of using, cleaning-up, discarding, and storing finishing materials including:

- Finishes
- Solvents
- Applicators
 - Brushes
 - Rollers
 - Pads
- Cleaning cloths

Point out how the above methods and procedures apply to the finishing room or area in the shop or laboratory.

Describe briefly at least one job related to wood finishing.

Discuss occupations related to finishing such as a painter, an industrial wood finisher, and a furniture refinisher. Include such items as requirements, entry-level jobs, duties, hazards, salaries, and outlook.

Prepare an inventory of finishing materials and supplies found in the home and indicate the correct storage place for each item.

List the dangers of improper use and storage of finishing materials and supplies.

List the procedures to follow when using the finishing area in the shop.

Prepare a list of jobs related to wood finishing.

Explain the safety procedures to follow when using wood finishing materials including thinning finishes, cleaning-up, and discarding and storing of unused finishes and solvents.

Explain how to use and store five different finishing materials or supplies.

Use safe work procedures when finishing projects or products made of wood.

Write a short report on a job related to wood finishing.

FORESTRY

Lessons 9-11

The forests supply the raw materials for many products such as lumber for construction and furniture, veneers and plywood, sports equipment, paper, charcoal, plastics, and various oils and solvents. The forest lands also provide areas for recreational activities such as camping, hunting, fishing, hiking, and skiing. It is important to know the characteristics of the various species of trees in order to use wisely the resources of the forests. The forests represent a renewable resource and it becomes necessary that conservation is practiced so that the forests and their products are available for future generations.

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
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Student will be able to:

Nature of Wood

Describe at least seven characteristics of wood that make it a desirable product to use in construction and/or manufacturing.

Discuss, using audiovisual aids, the characteristics of wood that make it desirable to use in construction and manufacturing. Give examples of products for such characteristics as:

- | | |
|---------------|-----------------------|
| • Strength | • Color |
| • Durability | • Grain pattern |
| • Workability | • Density |
| • Nailability | • Hardness |
| • Stability | • Resistance to shock |

Explain that as wood is a natural product the above characteristics will vary within species as well as among species.

Point out using a picture chart of a cross section of a log, the following items.

- | | |
|----------------|------------------|
| • Annual rings | • Sapwood |
| • Spring wood | • Heart wood |
| • Summer wood | • Medullary rays |

For each characteristic of wood discussed in class, list three examples of products or uses that utilize that characteristic.

From a list of 10 wood products, select seven and give the specific characteristics that make wood the suitable choice of material for each product.

Objectives

Instructional Suggestions

Student Learning Experiences

Evaluative Suggestions

Describe at least seven characteristics of wood that make it a desirable product to use in construction and/or manufacturing.

Prepare a chart showing the cross section of a log and distribute to the students.

Discuss the general principles to follow when constructing items of wood to reduce or prevent damage to the article as the wood shrinks or swells.

Classification

Explain the botanical classification of woods.

Explain and give examples of the botanical classification of woods (softwoods-coniferous; hardwoods-deciduous). Indicate that this classification does not refer to the relative hardness of specific woods.

State how woods are classified botanically.

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Give two uses each for at least eight softwoods.

Discuss at least 10 softwoods available for use in construction giving the characteristics and uses for each. Consider such softwoods as:

- Firs - Douglas, western, white,
- Pines - White, western, sugar ponderosa, yellow eastern, red
- Hemlock - Western, eastern
- Cedar - Red, white
- Cypress
- Redwood

Make a chart of the softwoods discussed in class and check specific characteristics and list uses for each.

For the softwoods available in the shop, actually check the ease of nailing for each species. Place the results in the form of a chart.

From a list of 20 woods select eight softwoods and give at least two uses for each.

Name and use correctly the softwoods available in the shop.

Actual samples of common softwoods are used for display and identification purposes.

Invite a carpenter to discuss how the various species and grades of softwoods are used in construction.

Give two uses each for at least eight hardwoods.

Discuss at least 10 hardwoods available for cabinet work, flooring and trim, sports equipment, and veneers giving the characteristics and uses for each. Consider such woods as Birch, Maple, Oak, Cherry, Basswood, Yellow poplar, Gumwood, Ash, Hickory, Walnut, and Mahogany - true and lauan.

Actual samples of common hardwoods are used for display and identification purposes.

Invite a cabinetmaker to discuss how and where the various species of hardwoods are used in woodworking.

Develop with the class a chart that lists wood products, properties required for that product, and suitable woods to use for each product.

Summarize the main points made by the speaker.

Make a chart of the hardwoods discussed in class and check specific characteristics and list uses for each.

For the hardwoods available in the shop, actually check the workability of each species by using common hand tools. Place the results in the form of a chart.

Summarize the main points made by speaker.

From a list of 20 woods, select eight hardwoods and give at least two uses for each.

Name and use correctly the hardwoods that are available in the shop.

From a list of 20 wood products, select 15 and indicate a suitable wood to use and give reasons for the wood selected for each product.

Objectives

Instructional Suggestions

Student Learning Experiences

Evaluative Suggestions

Products of the Forest

Show his/her dependency on the forests by listing at least 15 wood products or by-products used in daily living.

Develop with the class, using charts or posters, a list of products and by-products derived from the forests. Include items from such areas as:

- Lumber and lumber products
- Veneers and plywood
- Hardboard and particle board
- Paper and paper products
- Miscellaneous products

Bring in three or four articles from newspapers and/or magazines that deal with products of the forest.

Bring to class unusual products of the forest and indicate where they were obtained and how they are used.

Make a display, using pictures, of the various products obtained from the forests.

From a list of 20 products, select 15 that are obtained from the forest as a main product or by-product.

Production of Lumber

54 Describe briefly the production of lumber and related products.

Discuss briefly, using pictures and/or films, the harvesting of trees and the transportation of logs from the forest to the sawmill.

Discuss briefly, using pictures or film, the processing of logs into lumber. Include the cutting of the logs and the sorting and drying (air and kiln) of lumber.

Explain why lumber is kiln dried.

Discuss the transportation of lumber from the sawmill to a local lumber yard.

List the operations needed to take a tree from the forest to a sawmill.

List the operations needed to take a log and process it into dimensioned lumber.

List reasons why lumber is kiln dried.

Write a brief report on the production of lumber.

Arrange, when possible, a field trip to a local sawmill.

Discuss briefly a job related to the production of lumber.

Select the proper quality of lumber for specific situations or projects.

Discuss several occupations related to the production of lumber. Include for each requirements, entry-level jobs, duties, hazards, salaries, and outlook.

Discuss briefly, using actual samples or pictures, the defects that affect the quality or grade of lumber.

Discuss briefly, using charts of the different symbols, the various grades of softwood and hardwood lumber and give uses for each specific grade.

Arrange a field trip to a local lumber yard or building materials supplier to see the range of items available, storage facilities, and common sales units.

Compare the making of lumber at the local sawmill with similar operations conducted at a large sawmill. List the different occupations observed.

List occupations associated with the production of lumber.

List five defects that affect the quality or grade of lumber.

List the common grades of hardwood lumber.

List the common grades of softwood lumber.

List the basic types of materials available at the place visited. List different occupations observed.

List, using the yellow pages of a telephone directory, local places that sell lumber and lumber products.

Write a brief report on a job related to the production of lumber.

Explain why defects in lumber lowers its value and give specific illustrations.

For a product requiring lumber and plywood, make a list of the kinds and grades of each product needed for its construction.

From a list of 10 products or situations requiring lumber, select seven and give the class of wood and grade to use with reasons for each choice.

Report on the important items observed on the field trip.

Objectives

Select the proper quality of lumber for specific situations or projects.

Discuss briefly a job related to the retail lumber business.

Describe briefly the production of wood sheet materials.

Select the proper quality of wood sheet materials for specific situations or projects.

Instructional Suggestions

Discuss several occupations related to the retail lumber business. Include requirements, entry-level jobs, duties, hazards, salaries, and outlook.

Discuss, using pictures or charts, the process of cutting veneers and the making of plywood. Include also the laminating and molding of wood giving specific uses for each.

Discuss briefly, using pictures and/or films, the manufacture of hardboard and particle board. Include information on the different kinds and specific uses for each.

Discuss briefly the various grades of plywood, hardboard, and particle board giving specific uses for each.

Student Learning Experiences

Compare newspaper ads and flyers from local lumber dealers for prices, sizes, and grades of lumber and lumber products.

List five occupations associated with the retail lumber business.

List products found at home in which veneers are used and indicate the method of cutting used to produce the veneer for each product.

List the products found at home in which hardboard and/or particle board are used.

List the different grades of plywood.

List the different kinds of hardboard.

Evaluative Suggestions

Make a brief report on an occupation related to the retail lumber business.

Explain briefly three methods used to cut veneers and at least one advantage and use for each method.

List three advantages and three uses each for plywood and laminated wood.

List three situations where large sheets of wood materials are more useful than boards.

From a list of eight products or situations requiring wood sheet materials, select five and give the type to use along with the correct grade for each.

Production of Sheet Materials

Making of Paper

Describe briefly the production of paper.

Discuss, using pictures and films, the manufacturer of paper.

List the steps involved in the making of paper.

Write a brief report on the production of paper.

Arrange, when possible, a field trip to a paper mill.

Report on the processes observed. Also, list five jobs that were being performed.

Other Wood Products

Describe briefly the manufacture of two by-products of the wood industry.

Discuss briefly the manufacture of wood by-products such as: cellulose, chemical products, and lignin-based products.

Make a list of by-products made from wood that are used everyday.

List the steps involved in the making of two by-products of the wood industry and give three uses for each.

Explain briefly the manufacturing of two by-products of the wood industry.

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Recreational Use of Forest Lands

Describe briefly the activities available at forest recreational areas.

Develop with the students various activities that are available at forest recreational areas and give specific locations for each activity.

List the main forest areas in the State that provide recreational activities.

Select four recreational activities and for each one give at least two locations within a forest area in the State where these activities are available.

Invite a person, when possible, from the State Department of Environmental Conservation to discuss the activities available at forest recreational areas in New York State.

Summarize the important points made by the speaker.

Objectives

Describe briefly the activities available at forest recreational areas.

Instructional Suggestions

Have students, when possible, report on visits they have made to public or private forest recreational areas and indicate the facilities and activities available at these sites and the costs.

Student Learning Experiences

When possible, report on visits made to public or private forest recreational areas telling about the facilities and activities available.

Evaluative Suggestions

Compare the facilities and activities available and the costs at public forest recreational areas with similar offerings at private locations.

Research

Explain how research is trying to develop new products and uses for wood and improve existing wood products.

Discuss the research that is being conducted at the Forest Products Laboratory of the U.S. Forest Service located at Madison, WI and by private firms to develop new wood products, improve present wood products, and reduce wood waste.

Bring in newspaper and/or magazine articles that tell about new products or improvements in existing products made of wood or new uses for wood or its by-products.

Discuss briefly one new use or product of wood that has come about as the result of recent research and/or experimentation.

Describe briefly a job in the field of wood research.

Discuss several jobs in the field of wood research. Include requirements, entry-level jobs, duties, salaries, and outlook.

List occupations related to the field of wood research.

Write a brief report on an occupation in the field of wood research.

Conservation of the Forests

Explain the importance of maintaining a continuing supply of wood.

Develop with the class the importance of following specific management practices to insure that the forests are renewed and their products are available for future use.

Bring in newspaper and/or magazine articles that show the steps that are being taken to manage and renew our forest lands.

Explain why it is important to have a continuing supply of wood.

When possible, invite a conservation person, forest or park ranger, or a forester to discuss methods that are used to manage forest lands to insure continuing supply of wood.

Summarize main points made by the speaker.

List items of pollution and waste in the forest lands that are caused by people.

List at least five conservation practices which will reduce losses and insure a constant supply of wood.

Discuss the types of losses that annually occur to our forests and the steps that are being taken to reduce and/or prevent such losses.

List four causes of losses to the forest lands.

Bring in newspaper and/or magazine articles that relate to losses that are occurring on the forest lands.

List five conservation practices that are being followed to insure a constant supply of wood.

Discuss things that individuals can do to help reduce waste and pollution in our public forest areas.

Explain things an individual can do to help reduce the waste and destruction that is taking place in our forest lands.

Describe briefly a job related to the field of conservation.

Discuss several occupations related to the protection and conservation of forest lands. Include requirements, entry-level jobs, duties, hazards, salaries and outlook.

List occupations related to the protection and conservation of forest lands.

Make a brief report on a job related to the protection and conservation of forest lands.

Legislation

Explain some of the things the government is doing to insure that the forest lands are adequately maintained.

Discuss with the class recent laws and regulations that deal with the use of forest lands.

List recent laws and regulations that deal with the use of forest lands.

Explain the action the government is taking to reduce forest land losses and ensure the continued availability of the forest areas.

Discuss legislation that is being considered by the State and Federal governments which relates to the use of forest lands.

List the bills that are being considered by the State and Federal governments that relates to the use of forest lands.

Explain briefly one State and one Federal bill that is being considered which deals with the use of forest lands and give expected outcomes if passed into law.

Copies of such bills being considered are obtained from State and Federal legislators.

Objectives

Explain some of the things the government is doing to ensure that the forest lands are adequately maintained.

Instructional Suggestions

Obtain literature from special-interest groups that relate to the use of forest lands. Use this information as a basis for a class discussion of possible solutions for the wise use of forest lands for the benefit of the public in general over a short as well as a long period of time.

Student Learning Experiences

Collect literature from special-interest groups on topics that relate to the use of forest lands.

Bring in newspaper articles that deal with problems related to the use of forest lands.

Evaluative Suggestions

Have students give their position on at least two problems discussed in class and give reasons for their opinion.

INDUSTRIAL ORGANIZATION

Lessons 4-6

New and improved products and by-products of wood continue to be developed and made available to the public. Thus, it is important to know something about where and how many of these items are made in order to be able to make wise choices when purchasing them. Also, in our industrial economy, it is important to understand the roles of labor and management and the need for their working together in harmony in the manufacturing process.

Objectives	Instructional Suggestions	Student Learning Experiences	Evaluative Suggestions
Student will be able to:	<i>Wood Products Industries</i>		
Describe briefly the wood products industry.	Develop with the class a list of companies and/or firms that manufacture wood products and/or by-products. Discuss, using transparencies, the location of major firms and/or companies in New York State and the United States that make wood products and/or by-products. Note the effect that transportation costs have on the location of these firms. Develop reasons for certain types of products being manufactured in specific areas of the State and country. Discuss the wood products that are imported and the effect this has on U.S. manufacturing plants.	List at least eight different companies that make wood products and/or by-products. On outline maps of New York State and the United States, mark the locations of major plants that manufacture wood products and/or by-products.	Give a brief overview of the wood products industry including major products and the locations of plants in New York State and the United States. From a list of five firms that manufacture wood products, select one and indicate reasons why the plant is so located.
Explain briefly the manufacturing of a wood product.	Discuss briefly the manufacture of a wood product, such as an end table, a dresser, or chair. Include the general processes, such as the cutting of stock, shaping of stock into specific pieces, assembling, finishing, inspecting, and packaging.	Bring to class a list of 10 different wood products found in the home.	From a list of five wood products, select one and list the steps involved in its manufacture.

Objectives

Describe briefly at least one job involved in the manufacture of a wood product.

Instructional Suggestions

Discuss several of the jobs (skilled and semi-skilled) associated with the manufacture of wood products. Include the entry-level jobs, requirements, duties, opportunities for advancement, salaries, working conditions, hazards of the job, and outlook for employment.

Student Learning Experiences

List 10 different jobs associated with the manufacturing of wooden products.

Evaluative Suggestions

Write a report on a job associated with the manufacturing of a wood product. Include requirements, duties, working conditions, hazards, salaries, and outlook.

Discuss the advantages and disadvantages of a machine operator in a plant that mass produces a product.

Consumer Information

62 Explain the reasons for the difference in price between similar pieces of "quality" and "economy" furniture.

Contrast the methods used in the manufacture of "quality" furniture with those used in making "economy" furniture. Indicate the advantages of each type of furniture from the consumer's point of view. Give examples of when it would be appropriate to purchase each kind of furniture.

Bring in ads from newspapers and/or magazines that show pictures and/or give descriptions of similar pieces of furniture (a table or chest) but selling at different price levels ("quality" and "economy").

Develop a checklist of things to look for when purchasing furniture.

From descriptions for a piece of "quality" furniture and a piece of "economy" furniture explain the difference in costs based on materials used, construction features, and finish.

From several different catalogs showing similar products, select an item that would be considered a "best buy" and explain why.

Labor Management Relations

Distinguish between the roles of labor and management in the manufacturing process.

Develop with the class the role of labor in the manufacturing process.

Invite, when possible, a worker from a manufacturing firm to discuss what he/she believes to be labor's contributions to the production process.

Develop with the class the role of management in the manufacturing process.

Invite, when possible, an executive of a manufacturing firm to discuss what he/she believes to be management's contributions to the production process.

Explain the importance of labor and management working together.

Develop with the class the importance of maintaining harmony between labor and management in order to keep a company productive.

Discuss some of the consequences to a firm, the workers, and the community when there is disharmony between labor and management.

List the functions performed by labor in the manufacturing process.

Summarize the main points made by the guest speaker.

List the functions performed by management in the manufacturing process.

Summarize the main points made by the guest speaker.

Bring in articles that show the effect of labor-management relations on a firm, the workers, and community. Consider positive as well as negative aspects.

From a list of 15 functions associated with the manufacturing process, indicate those performed by labor and those performed by management.

Discuss, using examples, the interdependency of labor and management in the manufacturing process.

Job Information

List the characteristics that employers like their workers to exhibit.

Develop with the class a list of characteristics that employers like their workers to exhibit.

Make a list of the characteristics that employers like to have their workers exhibit.

Review the list of characteristics that employers like their workers to exhibit and develop a self-improvement plan to strengthen those items which need improving.

Objectives

Complete an application form for employment.

Explain how to prepare for and participate in a job interview.

Instructional Suggestions

Explain how to complete an application form for employment. Use as the basis for discussion, application forms from local firms.

Discuss how to prepare for and participate in a job interview.

Invite a personnel person from a manufacturing firm to explain how an individual should act during a job interview. Ask him/her to interview several students in a simulated situation and to suggest how their answers and actions might be improved.

Discuss the importance of getting along with others on the job.

Student Learning Experiences

Collect personal data that are needed to complete an application form for employment.

List the items that need to be done prior to a job interview.

Summarize the main points made by the speaker.

Participate in a simulated job interview.

Evaluative Suggestions

Complete an application form for employment.

Write a short report on how to prepare for and participate in a job interview.

List several techniques suggested by the speaker that might be used in a real job interview situation.

Explain why it is important to get along with others on the job.